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The 1982 Soviet Grain Crop: Reassessing the CIA Estimate

A Technical Intelligence Report

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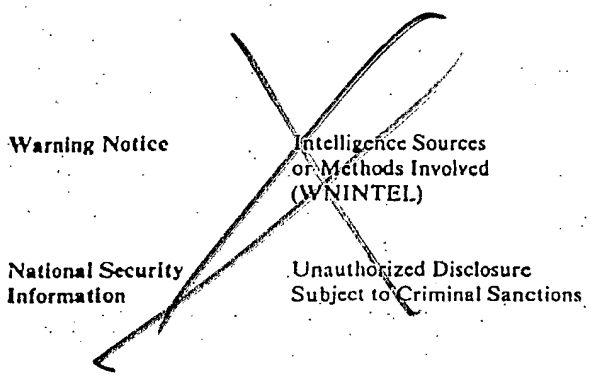

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Soviet Union: Major Grain Growing Regions

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The 1982 Soviet Grain Crop: Reassessing the CIA Estimate

Overview

Information available as of 10 November 1982 was used in this report.

Several months ago, we estimated that the 1982 Soviet grain crop would approximate 165 million tons, somewhat above last year's crop but well below what Moscow was expecting. Although the USSR has not announced the size of this year's grain harvest, remarks by Soviet officials can be interpreted as implying an output as low as 140 million tons or as high as 190 million tons. In view of this wide range and the slow pace of Soviet grain purchases, we reexamined our grain crop estimate—taking another look at the evidence and incorporating recently acquired data on straw dumps and Soviet grain procurements. The review helped us refine our assessment, but we found no reason for altering our view on the size of this year's crop. Because of the many variables involved, the 165-million-ton figure should be considered our best estimate, but one that is subject to error. The maximum range of error in our grain crop estimate over the past four years has been ± 8 percent.

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Table 1
USSR: Survey of 1982 Grain Crop Estimates

Date	Estimate (*million tons*)	Source/Comments
10 November	180	USDA official estimate
8 November	165	CIA
3 November	176	[redacted]
1 November	185	[redacted] consultant
31 October	190	Estimate made by the speaker at a public lecture in Leningrad in response to a question from the audience, with the caveat that perhaps no final figure would be given for 1981 to prevent "foreign blackmail."
19 October	185 •	[redacted] told th[redacted] that the 1982 Soviet harvest would be 27 million tons better than last year.
19 October	170	TANJUG-Yugoslav Press Agency, "According to unofficial Soviet sources this year's harvest (from around 125 million hectares) will yield some 170 million tons of cereals." Comment: Data released by the Soviet Central Statistical Agency indicates that the harvested area will not exceed 122 million hectares.
19 October	See comments	[redacted] in September 1982 that the 1982 Soviet harvest was "well below plan" and that production levels would barely exceed those accomplished in 1975. Grain production in that year totaled only 140 million tons.
8 October	170	USDA official estimate
4 October	180-190	[redacted] that his contacts in the Ministry of Agriculture gave him this information.
October	186	B. N. Chubinindze, Chief of Fats and Oil, USSR Ministry of Food and Industry, and V. Kuzmin, USSR State Planning Commission.
30 September	180	Estimate by the International Wheat Council.
30 September	167.6	CROPCAST-Earthsatellite Corporation. Estimate raised because wetness in the European USSR will bloat yields.
24 September	See comments	[redacted] that the US estimate of the Soviet grain crop (presumably USDA's 170 million tons) is "just a little too low."
15 September	163.3	CROPCAST-Earthsatellite Corporation
10 September	See comments	[redacted] that the 1981 crop was "about 160 million tons" and that this year's harvest would be "a little better than last year."
10 September	See comments	[redacted] that he understood that the 1982 harvest "is a little bit better than in 1981."
1 September	180	[redacted] consultant
September	179	Crop Condition Assessment Division, (Houston, Texas), Foreign Agricultural Service, USDA.
September	180	[redacted]
31 July	163.3	CROPCAST-Earthsatellite Corporation
26 July	165	CIA
15 July	168.8	CROPCAST-Earthsatellite Corporation
12 July	175	CIA
12 July	170	USDA official estimate
Early July	160	Officials of [redacted] grain trading firm
28 June	185	CIA
June	185	USDA official estimate

• Assumes that 1981 grain production was 158 million tons.

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The 1982 Soviet Grain Crop: Reassessing the CIA Estimate

CIA monitors Soviet agriculture year round. In estimating the crop, a team of analysts, including agronomists, agricultural economists, meteorologists, [redacted] use data from [redacted] weather stations, collateral, [redacted] to forecast annual grain production in the USSR. Because of the uncertainty surrounding the low level of Soviet grain purchases in recent months, we have reviewed our analysis of this year's grain crop. The review included an evaluation of what we know about other Soviet grain crop estimates, and the assessment of postharvest indicators, such as straw dumps and Soviet domestic grain procurements. To cross-check our estimate, we also used an alternative methodology that looks at grain production in six key areas.

A Survey of 1982 Soviet Grain Crop Estimates

Recent estimates of 1982 Soviet grain production range from about 140 tons to about 190 million tons (table 1). Estimates attributable to Soviet officials privy to internal information about the size of this year's crop cover the entire range of forecasts, thus providing little conclusive insight regarding the likely outcome of the harvest. Estimates by USDA and the Earth Satellite Corporation are in line with our estimate, indicating that the 1982 harvest will be slightly better than last year's—unofficially reported at about 160 million tons. Estimates by other Western experts on Soviet agriculture, including [redacted] and the International Wheat Council in London, tend to be on the high side, in our opinion. None of these authorities devote the resources, manpower, and methodology to the estimating process that CIA does. Moreover, our agronomist, chief meteorologist, [redacted] are in complete agreement concerning the size of this year's crop, and this is the strength of our analysis.

[redacted]

[redacted]

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Table 2

Table 3
USSR: Preliminary Procurement Data, 1982

Economic Region	Estimated Percent of Total Grain Production (1971-80 Average)	Percent of Oblasts Reporting	Date of Procurement Reporting [a]	Amount of Procurements [a]
Baltics	3	100	Normal	Above average
Belorussia	3	100	Normal	Above average
Central	6	92	Normal	Above average
Central Black Earth	6	80	Normal	Average
Volga	11	66	Late	Average
Volga-Vyatka	3	100	Normal	Average
North Caucasus	9	43	Normal	Below average
Ukraine	22	48	Late	Average
Urals	6	67	Normal	Average
Kazakhstan [b]	14	26	Normal	[c]
West Siberia	7	14	Normal	[c]

[a] Compared with the 1976-80 period.
[b] Kustanay is the only major grain-producing oblast in Kazakhstan that has reported as of 2 November. The relationship between yield and procurements is in agreement when comparing 1981 with 1982. Our 1981 estimate for yield in Kustanay was 11 c/ha while procurements were about 3 million tons. A recent Soviet press report placed this year's yield at 13 c/ha and procurements at 4 million tons. The record amount of grain sold to the state from Kustanay is 4.7 million tons.
[c] Insufficient data available to make a valid determination.

Grain Procurements

We have completed an analysis of all grain procurements reported in the Soviet press through 2 November. Although the level of state procurements does not necessarily relate directly to total production, it can indicate whether a region has experienced a comparatively good, average, or bad year. The procurement data analyzed reflects reporting primarily at the oblast level. We have aggregated it by region/republic in table 3. We believe the procurement data, or in some cases the lack of it, tend to support our current production estimate:

- Procurement reports from the Ukraine and the southern Volga valley are sparse; we believe that this indicates lower-than-average sales to the state (see map). In years when production was better than average in these major winter grain-producing areas, we had seen more procurement reporting by now. The lack of reporting from the Ukraine is of particular interest in that this area typically produces about 40 percent of the total winter grain crop.

- Conversely, press reports indicate that the level of procurements in the northern regions of European Russia (Baltic Republics, Central, Central Black Earth, and Volga-Vyatka) is much closer to average, and in some areas even above average. Our analysis indicates that grain production in these areas will be near average or slightly above average.

Table 4
USSR: Computations for Six Key Oblasts/Republic Methodology [a]

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982 [b]
Oblast/Republic													
Average yield *(centners per hectare)*	16.4	16.4	13.2	18.9	17.1	10.8	19.1	17.6	20.8	14.7	16.4	12.9	13.2
Altay	13.4	15.8	19.9	12.5	5.7	13.0	16.0	14.0	16.0 [b]	13.5	11.9 [b]	6.0	8.0
Severo-Kazakhstan	14.3	11.5	13.7	17.5	10.9	7.8	18.0	14.3	14.2	18.5	17.0 [b]	14.1	12.0
Orenburg	13.9	11.5	8.6	12.7	12.7	2.5	15.7	9.0	16.3	13.5	11.0 [b]	7.0	5.0
Volgograd	17.6	10.8	4.5	17.1	16.0	3.9	19.2	12.0 [b]	19.7	9.5 [b]	15.0 [b]	7.0	9.0
Dnepropetrovsk	22.6	27.1	15.3	31.7	30.7	18.1	NA	33.0	33.0	18.1 [b]	27.8	23.0	23.0
Belorussia	16.9	21.4	17.3	21.9	26.6	19.7	26.8	23.2	25.5	15.1	16.0	20.3	21.4 [c]
USSR													
Harvested area *(million hectares)*	119.3	117.9	120.2	126.7	127.2	127.9	127.8	130.3	128.5	126.4	126.6	125.5	122.0
Implied production [d] *(million metric tons)*	184.5	182.3	149.6	225.8	205.1	130.3	230.2	216.3	252.0	175.2	195.8	152.7	151.9
Actual production	186.8	181.2	168.2	222.5	195.7	140.1	223.7	195.7	237.4	179.2	169.1	158.0	
Percent of error	−1.2	0.6	−11.1	1.5	4.8	−7.0	2.9	10.5	6.2	−2.2	3.5	−3.4	

[a] The average yield for all grains grown in these areas correlates closely with the average all-grain yield for the USSR.
[b] Estimate.
[c] In late October the Soviet press reported a yield of 19.8 c/ha for 1982.
[d] Implied production = average yield (oblasts/republic) × harvested area (USSR) × 0.943 correction factor.

- Procurement information for the regions east of the Volga River—normally published by late October—is still largely unavailable.

Oblasts/Republic Methodology

As a check on our current estimating methodology, we used an alternate method to obtain a total grain production figure for the USSR. The "Six Key Oblasts/Republic Methodology" suggests a total crop of about 152 million tons for this year (table 4). The five oblasts (Altay Kray, Severo-Kazakhstan, Orenburg, Volgograd, and Dnepropetrovsk) and one republic (Belorussia) used in this methodology were selected because they generally experience the types of weather problems and growing conditions that exist in the principal winter and spring grain regions. The total average yield for all grains grown in the oblasts/republic correlates closely each year with the national average yield.

The area harvested nationwide multiplied by the average yield of the key oblasts/republic provides an approximation of total grain production. By comparing this number to actual annual production for the period 1970-80, we derived a 0.943 correction factor. This factor was then multiplied by the original approximation to obtain an implied grain production number for each year in the study period. Excluding 1977, [redacted] this surrogate for the standard UPSTREET estimating procedure has proved accurate to within ±4 percent. The range of errors has

Table 5
USSR: Growth Environment in Six Key Oblasts/Republic

Oblast/Republic	Key Month	1981					1982				
		Precipitation [a]	ETP [b]	Soil Moisture [c]		Estimated Yield (c/ha)	Precipitation	ETP	Soil Moisture		Estimated Yield (c/ha)
				Beginning of Month	End of Month				Beginning of Month	End of Month	
Spring grains											
Orenburg	July	10	202	7	1	7.0	24	227	5	1	5.0
Severo-Kazakhstan	July	67	180	34	28	14.1	44	180	17	13	12.0
Altay	July	66	168	4	12	6.0	38	160	17	10	8.0
Volgograd East	July	20	215	3	1	7.0	17	205	4	2	9.0
Winter grains											
Dnepropetrovsk	June	34	154	57	28	23.0	37	153	40	16	23.0
Volgograd West	June	56	187	41	24	18.0	69	162	42	27	18.0
Winter and spring grains											
Belorussia	June	75	121	36	35	20.3	57	113	53	27	21.4
	July	62	146	35	30		62	111	27	7	

[a] Precipitation (measured in millimeters of rainfall). Rainfall during the critical months of June and July are vital to plant growth and development. At this time of year low precipitation usually results in reduced yields. This year, precipitation was low in all spring grain areas.

[b] ETP (Evaporation Transpiration Potential). A measurement of demand placed upon the total plant system. Included in this parameter are temperature and wind movement. The higher the ETP values, the more stress the plant endures.

[c] Soil moisture (expressed as a percent of the soil's water-retention capacity). A calculated value that incorporates precipitation and ETP. The lower the soil moisture, the less water available to the plant's root system. Severe stress usually occurs when soil moisture is less than 25 percent of total available soil moisture.

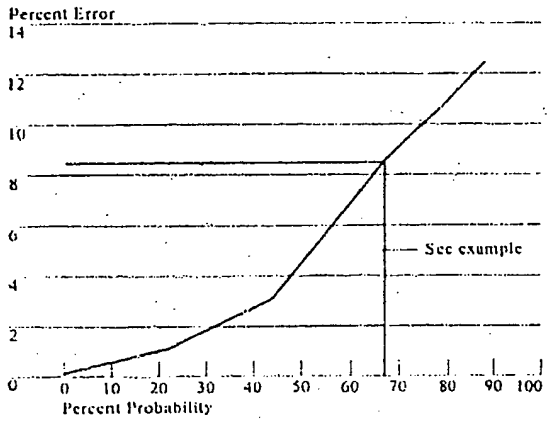
been from −11 percent to +6.2 percent. Using this methodology, the 1982 Soviet grain crop would not be expected to exceed 161 million tons.

We also have conducted a detailed 1981-82 comparison of the growing environment in the key oblasts/republic during June and July, the critical months during which winter and spring grains flower and yield potential is determined (table 5). In general, the comparison shows that overall growing conditions, as indicated by the combination of soil moisture, evapotranspiration and precipitation, were only slightly improved this year. In the areas where growing conditions were better this year, our published estimate of yields shows commensurate improvement

Probability of Error Analysis

Based on our track record over the past eight years, probability analysis shows that CIA estimates are within 9 percent of actual Soviet grain production two out of three times (see graph). We are within 12 percent of the reported figure 90 percent of the time. However, the number of data points represented by an eight-year period are statistically too few to generate a true error probability curve. If applied to this year's estimate, probability analysis suggests that there is one chance out of three that we could be off by 15 million tons, and one chance out of 10 that we could be off by 20 million tons. This is overly pessimistic in that errors in the early years of

USSR Grain Production:
Probabilities of Error in CIA Forecasts



Example: 67 percent of the forecasts have an error of 8.5 percent.

Table 6
USSR: Grain Production, Area, and Yield Analysis

Year	Production (*million tons*)	Area (*million hectares*)	Yield (*centners/ hectare*)
1976	223.7	127.8	17.5
1977	195.7	130.3	15.0
1978	237.4	128.5	18.5
1979	179.2	126.4	14.2
1980	189.1	126.6	14.9
1976-80 (average)	205.0	127.9	16.0
1981 [a]	158.0	125.5	12.6
1982 Scenarios			
Highly unlikely	190	122	15.6
Unlikely	180	122	14.8
Possible	170	122	13.9
Likely	165	122	13.5

[a] Production is the unofficially reported Soviet figure for the 1981 crop.

[ ] were considerably higher than those in recent years. Improvements in our weather data and model algorithms, and [ ] have enabled us, on the average, to come within 4 percent of actual Soviet grain production over the past four years (assuming that the 1981 crop was 158 million tons). Errors during this period ranged from −5.6 percent to about 8 percent. A similar range of error suggests that 1982 Soviet grain production could fall between 156 and 178 million tons.

Historical Yield and Acreage Data

A strong case can be made that this year's grain crop is not likely to be much larger than 165 million tons, a figure reached by analyzing historical harvested acreage data and average national yields (table 6). This year's harvested area—estimated to be about 122 million hectares—is the smallest in a decade, and that constraint alone places upper limits on the amount of grain that could possibly be produced, given this year's poor weather. Analysis of three possible cases—that is, if the crop comes in at 170 million, 180 million, or 190 million tons—indicates the following:

- A crop of 190 million tons harvested from an area of only 122 million hectares would give a nationwide yield of 15.6 centners per hectare (c/ha)—the fourth-highest yield ever. This case is highly unlikely.
- A crop of 180 million tons would require a yield of 14.8 c/ha—possible but also unlikely in our judgment.
- At 170 million tons, the yield becomes 13.9 c/ha—a possible achievement.

Assuming that last year's crop was only 158 million tons, a yield of 12.6 c/ha was obtained from a total harvested area of 125.5 million hectares. Our published estimate of 165 million tons implies a 1982 yield of 13.5 c/ha, which is consistent with the opinion of most Western experts on Soviet agriculture that this year's crop is somewhat better than last year's. The average all-grain nationwide yield during 1979-81 was 13.9 c/ha.